

Name: _____

Machine Tool Technology

Directions:

Evaluate the student by checking the appropriate number to indicate the degree of competency. The rating for each task should reflect **employability readiness** rather than the grades given in class.

Rating Scale:

- 0 No Exposure** – no experience or knowledge in this area
- 1 Not Mastered** – requires instruction and close supervision
- 2 Requires Supervision** – can perform job completely with limited supervision
- 3 Mastered** – can work independently with no supervision

NOTE:

* = Core competencies (essential for the first day on the job).

0	1	2	3	A. Appreciate and apply all personal and workplace safety procedures	NTMA
				*1. Operate safely in the workshop in compliance with appropriate OSHA and EPA guidelines	I-5.2, 6.1
				2. List machine shop safety rules and regulations	I-5.1, 6.1
				Other:	

0	1	2	3	B. Perform machine tool-related mathematical calculations	
				*1. Convert common fraction to decimal fraction and vice versa	KSAO I-2.1
				*2. Determine tap drill size with formula and charts	I-2.1, 2.8
				*3. Convert customary measurements to metric and vice versa	
				*4. Use calculator to perform mathematical operations	
				*5. Verify the accuracy of calculations derived with a calculator	
				*6. Calculate amount of stock required	
				7. Calculate part and feature dimensions and locations	I-2.2, 2.6
				*8. Convert revolutions per minute (rpm) to surface feet per minute (sfpm)	
				*9. Calculate feeds and speeds	
				10. Determine tapers for machine set-up per formulas and charts	
				11. Determine sine bar set-up with formulas and charts	
				12. Perform angular and simple indexing calculations	
				*13. Calculate measurements of right triangles	
				Other:	

0	1	2	3	C. Measure machined parts using industry recognized instruments	I-3.1 (mostly KSAOs-related theory)
				*1. Measure using direct-reading instruments (such as scales, protractors, and precision levels)	

				*2. Measure using transfer instruments (such as plain inside and outside calipers, telescoping gages, adjustable hole gages, and adjustable parallels)	
				*3. Measure using precision measuring instruments (such as micrometers, gage blocks, verniers, dial indicators, and digital calipers)	
				4. Measure using surface plate instruments (such as height gages, angle plates, and sine bars and plates)	
				5. Measure using comparison instruments (such as radius gages, squares, cutter tooth gages and center gages)	
				6. Measure using other instruments (such as optical comparators, coordinate measuring machines [CMM])	
				7. Measure pitch diameters using thread wires	
				Other:	

0	1	2	3	D. Interpret designs, drawings, and specifications	
				*1. Interpret blueprints including common drafting symbols	KSAO I-5.1, 5.2
				*2. Make a sketch from a finished workpiece	
				3. Calculate tolerances and allowances	
				*4. Calculate missing dimensions	
				5. Use geometric dimensioning and tolerancing	KSAO I-5.2
				Other:	

0	1	2	3	E. Plan work consistent with industry standards	
				*1. Use Machinery's Handbook to plan work	I-2.1 thru 2.9
				2. Plan sequence of part layout based on blueprint information	I-1.1, II-1.1
				3. Plan sequence of machining operations	I-2.3 thru 2.9, II-1.1
				Other:	

0	1	2	3	F. Inspect machined parts using industry standard tools/equipment	
				*1. Inspect part using hand tools (such as scales, micrometers, verniers, and protractors)	I-3.1
				2. Inspect part using surface plate instruments (such as indicators, height gages, angle plates, height-transfer gages, and sine bars and plates)	I-3.1
				3. Inspect part using optical comparator	II-3.1
				4. Inspect part using CMM (coordinate measuring machine)	II-3.2
				Other:	

0	1	2	3	G. Collect and analyze quality control data	
				1. Follow a quality plan	I-3.2
				2. Participate in capability study	II-4.1
				3. Analyze the performance of a single-part production process	I-4.1
				4. Analyze the performance of a production process	I-4.2
				Other:	

0	1	2	3	H. Layout and fabricate bench work consistent with industry and safety standards	
				*1. Use and care for hand tools	KSAO
				*2. Cut materials with hand hack saw	I-2.1
				*3. Mark locations with prick and center punches	I-2.1, II-2.1
				4. Locate holes with transfer screws and transfer punches	I-2.1, II-2.1
				*5. Bench file/deburr workpiece	
				6. Cut threads with die	I-2.1
				7. Cut threads with hand tap	I-2.1
				8. Ream holes with hand reamer	I-2.1
				9. True and dress grinding wheels on pedestal/bench grinder	
				10. Grind and shape tools on pedestal/bench grinder	
				11. Use abrasives/whetting/polishing/lapping	III-2.1
				12. Grind using appropriate hand grinder	
				13. Remove damaged screws	
				14. Remove broken drills and taps	
				15. Remove and install dowel pins	
				16. Install a thread insert	
				17. Straighten workpiece on arbor press	
				18. Assemble and disassemble workpiece with arbor press	
				19. Broach workpiece with broaching tool	
				20. Assemble and disassemble precision parts	
				Other:	

0	1	2	3	I. Describe and conduct material sciences procedures	KSAOs
				*1. Identify types of metals and related materials	

				2.	List properties that affect machinability	
				3.	Correlate types of materials to their properties	
				4.	List major cutting tool variables	
				5.	Perform heat treatment process	
				*6.	Test workpiece for hardness with and without hardness tester	
				7.	Interpret time-temperature-transformation diagrams	
				8.	Identify the effect of heat treatment on materials	
				Other:		

0	1	2	3	J.	Operate power saws consistent with industry and safety standards	
				*1.	Employ power saw safety guidelines	
				*2.	Perform power saw care and maintenance	
				3.	Select blade type for sawing operations and materials	
				4.	Cut and weld band saw blades	
				*5.	Select and set speeds and feeds on power saw	
				*6.	Cut material to length with power saw	I-2.9
				*7.	Select and apply cutting fluids	KSAOs
				8.	Contour saw to scribed line	II-2.2
				9.	Saw internal contours with band saw	II-2.2
				Other:		

0	1	2	3	K.	Operate drill presses consistent with industry and safety standards	
				*1.	Employ drill press safety guidelines	
				*2.	Perform drill press care and maintenance	I-5.1, 5.2, 5.3
				*3.	Set up and clamp workpiece to drill press table	I-2.8
				*4.	Select drill type based on job requirements	I-2.8
				5.	Determine cutting tool variables prior to use	
				*6.	Set up drill press according to calculated feeds and speeds	I-2.8
				*7.	Select and apply cutting fluids	
				*8.	Drill holes to specification using manual feed	I-2.8
				*9.	Drill holes to specification using automatic feed	

				*10. Countersink hole to specifications	I-2.8
				*11. Counterbore hole to specifications	I-2.8
				*12. Spotface to specific dimensions	I-2.8
				*13. Mount workpiece on V-blocks	
				14. Power ream hole to size	I-2.8
				15. Use drill jigs and bushings	
				*16. Hand tap hole using drill press	
				17. Tap hole with tapping attachments	I-2.8
				18. Perform taper reaming and subsequent pipe tapping	II-2.14
				*19. Sharpen drills at a pedestal grinder or with grinding attachments and specialized grinders	
				20. Set up radial drill press	II-2.13
				Other:	

0	1	2	3	L. Operate lathes consistent with industry and safety standards	
				*1. Employ lathe safety guidelines	I-6.1
				*2. Perform lathe care and maintenance	I-5.1, 5.2, 5.3
				*3. Align lathe centers using test bar and dial indicators	I-2.3, II-2.3
				*4. Select cutting tool based on job requirements	I-1.1, II-1.1
				*5. Calculate feeds and speeds for lathe set-up	I-1.1, II-1.1
				*6. Free-hand grind turning and facing tools	I-5.3
				*7. Select and apply cutting fluids	KSAOs
				*8. Operate lathe controls	I-2.3, 2.4, II-2.3, 2.4, 2.5
				*9. Face workpiece and center drill	II-2.4
				*10. Set up tooling	I-2.3, 2.4, II-2.3, 2.4, 2.5, III-2.3, 2.4, 2.5, 2.6
				*11. Turn workpiece between centers	I-2.3, II-2.3
				*12. Indicate workpiece in four-jaw chuck	I-2.4
				*13. Drill holes	
				*14. Ream holes	
				*15. Bore holes	II-2.5
				*16. Countersink holes	

				*17. Counterbore holes	
				18. Knurl parts	
				19. Free-hand grind 60-degree threading tool	
				20. Chase external/internal threads	
				21. Chase metric threads	
				22. Cut multiple lead threads	
				23. Cut Acme threads	
				24. Use compound rest to cut short external/internal tapered surfaces	II-2.3
				25. Cut tapers by offset tailstock	II-2.3
				26. Cut external tapered surface with taper attachment	II-2.5
				27. Cut internal tapered surface with taper attachment	II-2.5
				*28. Align workpiece on faceplate	
				*29. Perform lathe filing	
				*30. Polish workpiece	
				31. Turn or thread long workpieces using follower and steady rest	III-2.4
				32. Use form tooling	III-2.3
				33. Use mandrel	
				Other:	

0	1	2	3	M. Operate milling machines consistent with industry and safety standards	
				*1. Employ milling machine safety guidelines	I-6.1
				*2. Perform care and maintenance of milling machine	I-5.1, 5.2, 5.3
				*3. Tram (align) mill head	
				*4. Select milling machine attachments according to job requirements	I-2.3, 2.4, 2.5, II-2.10, 2.11
				*5. Align workpiece mounted on machine table	
				*6. Calculate feeds and speeds and set up mill accordingly	I-1.1, II-2.1
				*7. Select and apply cutting fluids	KSAOs
				*8. Select cutting tool based on job requirements	I-1.1, II-1.1
				*9. Square up workpiece in milling vise using face mill	II-2.6
				10. Mill workpiece with end mill	I-2.6, II-2.6
				11. Locate work with edge finder	

				12. Drill holes with milling machine	II-2.7
				*13. Ream holes	
				*14. Bore holes with milling machine	II-2.7. 2.12
				15. Use form cutter to mill workpiece	
				16. Machine workpiece mounted on V-blocks	
				*17. Machine external straight keyway	II-2.8
				*18. Machine woodruff keyway	II-2.8
				*19. Mill simple and compound angles	III-2.7
				20. Mill an external radius with rotary table	II-2.10
				21. Mill an internal radius with rotary table	II-2.10
				*22. Mill workpiece using simple indexing operation	II-2.11
				*23. Use digital readout	
				24. Machine workpiece by straddle milling	
				25. Perform gang milling	
				Other:	

0	1	2	3	N. Operate grinders consistent with industry and safety standards	
				*1. Employ grinder safety guidelines	I-2.7a, I-6.1
				*2. Perform grinder care and maintenance	I-5.2
				*3. Select and apply cutting fluids	KSAOs
				*4. Inspect and ring-test grinding wheel	I-2.7a
				5. Balance grinding wheel	II-2.17, III-2.10
				*6. Select and mount grinding wheel	I-2.7a
				*7. True and dress machine tool grinding wheel	I-2.7a
				8. Grind workpiece on magnetic chuck using power feed	I-2.7b, II-2.15
				*9. Square up workpiece on surface grinder	II-2.15
				*10. Indicate workpiece to be ground	
				11. Dress form on grinding wheel	
				12. Grind form into part	
				13. Grind angular surfaces	II-2.16
				14. Grind straight and tapered surfaces between centers using cylindrical grinding	II-2.18, III-2.11

				Other:	
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0	1	2	3	O. Fabricate and resurface cutting tools consistent with industry and safety standards	
				*1. Employ tool-and-cutter grinding safety guidelines	
				*2. Perform care and maintenance of tool-and-cutter grinder	
				*3. Inspect and ring-test grinding wheels	
				4. Select and mount grinding wheel	
				5. True and dress grinding wheel	
				6. Set up machine	
				7. Sharpen cutters on tool-and-cutter grinders	
				Other:	

0	1	2	3	P. Operate and maintain computerized numerical control (CNC) machines consistent with industry and safety standards	
				*1. Employ CNC machine safety guidelines	I-6.1
				*2. Perform care and maintenance	I-5.1, 5.2, 5.3
				3. Calculate coordinates and dimensions needed for CNC program	
				4. Write program for CNC machine	II-2.21, III-2.16
				5. Produce RS-274-D program using manufacturing modeling software	III-2.17
				6. Set up a CNC machine	III-2.18, 2.19
				7. Machine workpiece with CNC machine	II-2.22, 2.23, III-2.18, 2.19
				Other:	

0	1	2	3	Q. Operate electric discharge machines (EDM) consistent with industry and safety standards	
				1. Operate a plunge electric discharge machine	II-2.19
				2. Operate a two-axis electric discharge machine	II-2.20

0	1	2	3	R. Demonstrate leadership skills in the classroom, industry, and society **	
				1. Demonstrate an understanding of VICA, its structure, and activities	
				2. Demonstrate an understanding of one's personal values	
				3. Perform tasks related to effective personal management skills	
				4. Demonstrate interpersonal skills	
				5. Demonstrate etiquette and courtesy	

				6. Demonstrate effectiveness in oral and written communication	
				7. Develop and maintain a code of professional ethics	
				8. Maintain a good professional appearance	
				9. Perform basic tasks related to securing and terminating employment	
				10. Perform basic parliamentary procedures in a group meeting	
				Other:	

****NOTE: These competencies are addressed in the Missouri SkillsUSA-VICA Curriculum Guide lessons**

0	1	2	3	Explain and demonstrate skills in a specialization area identified by the instructor	
				1.	
				2.	
				3.	
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				10.	